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Book Review: <i>Snakes of the Eastern United States</i> by Whit Gibbons	Brian S. Gray	113
Notes on the Testicular Cycle of Southeastern Five-lined Skinks, <i>Plestiodon inexpectatus</i> (Squamata: Scincidae), from North Carolina	Stephen R. Goldberg	116
Pick Your Poison	Aquila Wilks	118
A Note on the Distribution of the Eastern Musk Turtle, <i>Sternotherus odoratus</i> , within the North and West Branches of the Susquehanna River, Pennsylvania	Sean M. Hartzell	122
A Little about a Lot: Lyresnakes, My Way!	Roger A. Repp	123
What You Missed at the June Meeting	John Archer	128
Advertisements		131
New CHS Members This Month		131
Minutes of the CHS Board Meeting, June 16, 2017		132
Show Schedule		132

Cover: In situ image of a Sonoran lyresnake (*Trimorphodon lambda*) basking in a wet crevice during a cold desert rain shower, 22 November 2013. Photograph by Martin J. Feldner.

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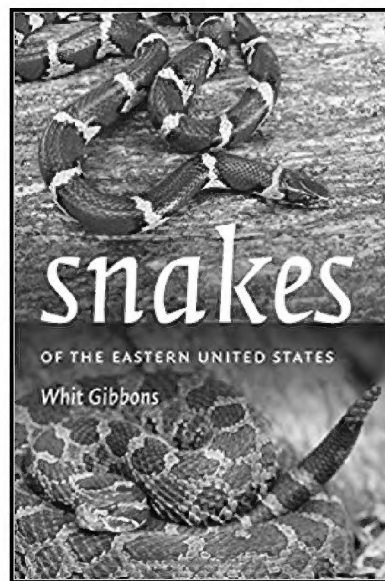
Book Review: *Snakes of the Eastern United States* by Whit Gibbons
2017. The University of Georgia Press, Athens, Georgia (www.ugapress.org).
416 pp. Softcover. US\$32.95. ISBN 978-0-8203-4970-1.

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It is well known to herpetologists that many people have a fear and/or dislike of snakes. Such emotions are based partly on a lack of knowledge or misinformation regarding these animals. That being said, it is also known that a person's prejudices towards snakes can be reversed if they are educated with the facts about these magnificent animals (Krulikowski, 2004). I am convinced that anyone—including those that may disdain snakes—who picks up *Snakes of the Eastern United States* by Whit Gibbons, and reads it cover to cover, cannot help but gain respect and admiration for these misunderstood reptiles.

The area covered by this guide includes all states east of the Mississippi River from Wisconsin south to Mississippi, and all of Louisiana. The book has an attractive, sturdy soft cover adorned with images of a scarlet kingsnake (*Lampropeltis elapsoides*) and a massasauga (*Sistrurus catenatus*) that should encourage anyone with even a slight interest in snakes to pick the volume up for closer inspection. The binding is solid and should handle being taken in the field. The book is divided into four main sections: "All about Snakes," "Species Accounts," "People and Snakes" and "What Snakes Are Found Where You Live?" Throughout the book are "Did You Know?" boxes that highlight interesting or anomalous facts about snakes.

In the first section, "All About Snakes," Gibbons discusses snake biology, diversity and ecology, and also provides a discussion regarding characteristics (e.g., colors and pattern, body size, scale types) useful in snake identification. A great deal of information is crammed into the 44 pages of this section, a good foundation for one of Gibbons's goals in writing the book: "to interest young people and adults who may have missed an earlier opportunity to get to know this group of captivating yet often maligned animals." Overall, the information provided in this section is well-written, interesting and accurate. I found only a couple of apparently inaccurate statements. On page 5, the caption for an image of a short-headed gartersnake (*Thamnophis brachystoma*) states that the species is known from only a few counties in three states (New York, Pennsylvania and Ohio). In Pennsylvania alone, *T. brachystoma* is known from at least 15 counties (Hulse et al., 2001), while in Ohio and New York it is known from two and four counties respectively (Gibbs et al., 2007; Novotny et al., 2011). The statement on page 13, that "all snakes swallow their prey whole" is not quite accurate. Gerard's water snake (*Gerarda prevostiana*) and the crab-eating snake (*Fordonia leucobalia*) of Southeast Asia dismember crabs while consuming them (Jayne et al., 2002). Furthermore, one could argue that the removal of the body of a snail from its shell by a feeding *Storeria dekayi* or *S. occipitamaculata* is another exception.



The second section, "Species Accounts," is the bulk of the book (295 pages). Gibbons chose to group the accounts into six categories, based on body size and ecology (e.g., terrestrial or aquatic), stating that these are "easily understandable and provide an approach that will help people become more aware of the similarities and differences among the snakes of the eastern United States." Sixty-three native species (seven of which are venomous) and four introduced species are included. Species accounts are typically 3–5 pages in length, but some, such as those for the ratsnake (*Pantherophis obsoletus*) and racer (*Coluber constrictor*), are 7 pages. Within each account, and below the initial image of a particular species, is a "quick identification guide" box, which provides a brief summary of the snake's scale type (keeled or smooth), condition of the anal plate (single or divided), body shape, color and pattern, distinctive characters, and a size chart illustrating the relative sizes of neonates, typical adults, and the largest individuals of a species. Following this is the main body of each account, which contains a description of adult and juvenile color and patterns, with subspecies being described where pertinent. The descriptions are complemented by 2 to 18 images, although most accounts contain from 3 to 5. The images are of exceptional quality and were contributed by 55 individuals, who are credited near the end of the book. The images along with the text should allow even novice snake enthusiasts to make identifications. I particularly liked the inclusion, in many of the accounts, of images representing intraspecific and ontogenetic variation in pattern, as well as the depiction of various behaviors (e.g., feeding, defensive, mating). Also included in each account are sections on distribution and habitat, behavior and activity, food and feeding, reproduction, predators and defense, conservation, and what's in a name. The information provided in the accounts is compendious. For example, in the "food and feeding" subsection of most accounts (in a mere paragraph) Gibbons provides not only a list of what is eaten, but also how (e.g., constriction, envenomation, etc.), and when hunted (diurnally or nocturnally), and where pertinent, differences between juvenile and adult diets. The conservation status of each snake is presented and includes discussion of species-specific threats. The "What's in a Name?" subsection provides the reader with a brief history of who first described and named each snake, where the "first" specimen was collected, as well as breaking down the scientific names into their primarily Latin or Greek roots. The biographical tidbits introduce the reader to many herpetological pioneers, such as Spencer F. Baird, Edward D. Cope, and J. E. Holbrook, to name a few. If there is disagreement among herpetologists as to the taxonomy of a particular snake, this is also mentioned.

The species accounts also include discussion of four established nonnative species: Brahminy blind snake (*Ramphotyphlops braminus*), Burmese python (*Python molurus bivittatus*), northern African python (*P. sebae*), and boa constrictor (*Boa constrictor*). In place of the conservation subsection provided for native species, the impacts of each introduced species are described. For example, regarding Burmese pythons in Everglades National Park Gibbons states: "Within only a few years after python numbers increased, the relative abundances of raccoons and opossums dropped 99 percent, deer 94 percent, and bobcats 87 percent." As for typographical errors, I noted only a single example on page 191, with "Blainville" being misspelled "Blaionville."

A map illustrating each species' distribution in the eastern United States is provided, along with a smaller insert map depicting the range within the continental United States. Different colors of shading are used to illustrate the distributions of subspecies and intergrades when appropriate. For the most part, the maps do provide a good approximation of the actual presence of a species. There are a couple instances where the illustrated distribution does not quite match the known distribution of a species, or there is a discrepancy between the text and the corresponding map. Regarding the distribution of the short-headed gartersnake (*Thamnophis brachystoma*), it is noted (and illustrated on the map) that "introduced populations persist in the Pittsburgh area and in Youngstown, Ohio." However, no mention is made (or mapped) of the city of Erie, Pennsylvania, where introduced populations of *T. brachystoma* have persisted since at least 1970 (Conant, 1975; Price, 1978). Conversely, the presumably introduced population at Horseheads, New York (Wright and Wright, 1957), is not mentioned in the text but is depicted on the map (p. 77). In the account of Butler's garter-snake (*T. butleri*), its geographic distribution is described as being found in scattered localities in Indiana, Ohio, Michigan, and Wisconsin. However, on the map (p. 135) the range in Wisconsin is not illustrated. The queen snake (*Regina septemvittata*) is stated as being absent from New Jersey, but distribution on the complementary map (p. 236) includes a portion of southwestern New Jersey. In the account for Kirtland's snake (*Clonophis kirtlandii*), the corresponding map (p. 73) depicts an extensive historical range in Pennsylvania. It could have been mentioned that the species is listed as endangered in Pennsylvania and hasn't been collected there since 1965 (Hulse et al., 2001). In addition to the subsections found in the other accounts, each venomous snake account contains a subsection titled "How Dangerous are They?" Here the author provides information regarding the toxicity of venom and its effects on the body, notes rarity of bites from venomous snakes, and also provides sound advice on preventing being bitten: Do not handle venomous snakes.

"People and Snakes" is the third major section of the book (pages 365–390). The section begins with describing what a herpetologist is, and briefly explains why some study snakes (it's not because we are crazy!) and how they accomplish that. Images of young snake enthusiasts looking for snakes under tin, and images of herpetologists in the field effectively supplement the text. A discussion of urban snakes follows. Gibbons notes that urban snakes "offer many opportunities for people to become familiar with a fascinating element of nature and to edu-

cate others about them as well." A fine image of a common gartersnake on a road in a residential neighborhood, and another of a ratsnake making its way up the exterior of a home effectively depict snakes in an urban environment. I really liked the inclusion of the table: "Most common snakes found in 25 of the largest eastern cities (pages 374–375). Of the cities listed, Philadelphia has the least (n = 3) and Jacksonville has the most (n = 13). While I do not live in one of the 25 cities, I enjoyed comparing the number of snake species in nearby cities (Cleveland and Pittsburgh) to my own (Erie, Pennsylvania). The table also allows one to compare the number of snake species in northern cities with southern ones. The topic of snakes as pets is briefly touched upon, with Gibbons pleading with those wishing to keep a snake for a pet to acquire only captive-bred animals, as this "provides an environmental service by helping reduce the removal of snakes from the wild." He also provides sound advice to check local, state, and federal laws before purchasing a snake. It is also recommended that the potential snake owner understand the importance of a snake's requirements in captivity by consulting books specifically dealing with herpetoculture prior to acquiring the animal.

The conservation of snakes is a recurring theme throughout the book, and I agree with Gibbons that "educating the public about the fascinating behavior, ecological value, and minimal threat associated with snakes is the first step toward developing a general attitude that snakes have far more to offer than most people realize." Gibbons makes a convincing case for conserving snakes that includes their significance as predators and prey in natural ecosystems, as well as their importance as bioindicators and biomonitors of environmental integrity. He also reviews threats to snake populations, reminding the reader that habitat loss is detrimental to other wildlife as well as snakes, and touches on conservation laws, and people's polarized feelings toward snakes. The section ends with answers to ten frequently asked questions about snakes, such as: Can snakes bite underwater? I felt like this group of questions/answers would have been better placed within the "All About Snakes" section. Perhaps it was meant to illustrate one method of educating the public?

The book concludes with a section titled "What Snakes Are Found Where You Live?" and consists of two tables and two maps. The first table (pages 392–393) presents the "occurrence by state of the 63 species of native snakes, listed in the order of those occurring in the most to least number of states." Four introduced species are included at the bottom of the table. In a glance, one can compare the diversity of snakes in one state with that in any of the others. For instance, Florida (49 total species) with Maine (10 species). The second table, "Conservation status of snakes in the eastern United States," lists 48 species of snake and indicates which states have designated state and federal conservation status for each species. Gibbons notes that if a snake species was not recognized for state or federal conservation concern before 2016 they were not included in the table. I decided to check two states that I am most familiar with to determine accuracy. The designated species for New York agreed with current regulations for that state (NYSDEC, 2017). However, checking the table for my home state of Pennsylvania, only the massasauga (*S. catenatus*) and the common kingsnake (*L. getula*) were included, listing them as federal conservation

concern and state conservation concern, respectively. However, *L. getula* is not included in the herpetofauna of Pennsylvania (Hulse et al., 2001; Pennsylvania Fish and Boat Commission, 2017), nor is it listed as a species of conservation concern (Steele et al., 2010; Pennsylvania Code, 2017). There are, however, additional species that should have been listed: Kirtland's snake (*Clonophis kirtlandii*), which was last collected in the commonwealth in 1965, is endangered (Hulse et al., 2001), and the rough green snake (*Opheodrys aestivus*) is listed as endangered (Hulse, 2010; Pennsylvania Code, 2017). The timber rattlesnake (*Crotalus horridus*) is a Candidate species in Pennsylvania (Reinert, 2010). Seeing that laws and regulations pertaining to amphibians and reptiles can, and do change over time, consulting the web page for your state's regulatory agency is recommended. The two maps that follow provide a quick overview of the variation in the numbers of snake species present in the area covered by this guide. The color-coded maps indicate the number of species with shading—the darker the shading, the greater the number of species. The second map illustrates the variation in the numbers of venomous snake species in the eastern United States. My only criticism of this latter map is that it implies that there is at least one venomous species (*S. catenatus*) present as far north as Cleveland, Ohio, and into western Erie County, Pennsylvania. To my knowledge, there are zero dangerously venomous snake species in Erie County,

Pennsylvania (Gray and Lethaby, 2008).

The book includes a glossary of terms that readers may be unfamiliar with, such as aestivation (a period of inactivity during dry and/or hot periods). A Further Reading list of 42 titles is provided and is adequate to get interested individuals well on the way to furthering their knowledge of snakes. As a Pennsylvanian, however, I was disappointed that Hulse et al. (2001) was not included in the list. Six pages of acknowledgments and photo credits are followed by two indices, one of scientific names and another of common names.

I do not believe that the minor issues noted above detract in any way from the usefulness and quality of this book. *Snakes of the Eastern United States* is an aesthetically pleasing, well-written, information-packed book that should appeal to a wide audience, from the neophyte snake enthusiast to the seasoned herpetologist. Furthermore, with its strong conservation message, the usefulness of *Snakes of the Eastern United States* goes well beyond that of a field guide. Towards the end of the book, Gibbons offers “the best hope to protect the natural habitats of snakes and prevent malicious killing lies in changing public attitudes through education.” This book is an educational tool and potential attitude changer.

I offer my sincere thanks to Jeffrey C. Beane for reviewing a draft of this review.

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Notes on the Testicular Cycle of Southeastern Five-lined Skinks,
Plestiodon inexpectatus (Squamata: Scincidae), from North Carolina

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Abstract

A histological examination of testes from *Plestiodon inexpectatus* from North Carolina was conducted. Males commence sperm formation (spermiogenesis) in April. The smallest reproductively active male measured 60 mm snout–vent length and was from March. Events in the testis cycle of *P. inexpectatus* from North Carolina are timed similarly to those of *Plestiodon gilberti* from California and *Plestiodon laticeps* from Oklahoma, in which 85% and 100% of the males, respectively, were undergoing May spermiogenesis. In contrast, 94% (16/17), *Plestiodon* (as *Eumeces*) *skiltonianus* from southern California and 100% (3/3) *Plestiodon multivirgatus* from New Mexico had commenced spermiogenesis in March, indicating an earlier start to male reproductive activity. The advantages of males starting reproduction at an earlier time of the year are not clear and merit further study.

The southeastern five-lined skink, *Plestiodon inexpectatus* (Taylor, 1932), ranges from Virginia through Florida to the Dry Tortugas and west to the Mississippi River (Powell et al., 2016). The biology of *P. (as Eumeces) inexpectatus* is summarized by Steiner (1986). Information on *P. inexpectatus* female reproduction from Alabama is in Mount (1975); Florida: Duellman and Schwartz (1958); Louisiana: Dundee and Rossman (1989), Boundy and Carr (2017); Mississippi: Smith and List (1955); North Carolina: Palmer and Braswell (1995), Platt and Rainwater (2000); Tennessee: Niemiller et al. (2013); Virginia: Mitchell (1994). In this note I present the first histological information on the *P. inexpectatus* testicular cycle from museum specimens. Utilization of museum specimens for obtaining reproductive data avoids removing additional animals from the wild.

Fifteen males of *P. inexpectatus* (mean snout–vent length, SVL = 68.6 mm ± 4.5 SD, range = 60–75 mm) from North Carolina were borrowed from the herpetology collection of the North Carolina State Museum of Natural Sciences (NCSM), Raleigh, North Carolina, U.S.A., for a histological examination of the testicular cycle. *Plestiodon inexpectatus* were collected 1961 to 1989 (Appendix).

The SVL of each specimen was measured to the nearest mm, from the tip of the snout to the posterior margin of the vent. A small incision was made in the lower part of the abdomen and

the left testis was removed for histological examination. Testes were embedded in paraffin, sections were cut at 5 µm and stained with Harris hematoxylin followed by eosin counterstain (Presnell and Schreiber, 1997). Slides of testes were examined to determine the stage of the testicular cycle. Histological slides were deposited at NCSM.

Monthly stages of the testicular cycle are in Table 1. Four stages were present: (1) Regressed: seminiferous tubules are at their smallest size and contain spermatogonia and interspersed Sertoli cells; (2) Recrudescence: a proliferation of germ cells occurs for the next period of spermiogenesis (sperm formation), and is characterized by the appearance of primary spermatocytes; (3) Late recrudescence: the spermatogenic cycle has progressed to where secondary spermatocytes and spermatids, but no sperm are present; (4) Spermiogenesis: lumina of the seminiferous tubules are lined by sperm, or clusters of metamorphosing spermatids. The smallest reproductively active male was in late recrudescence (spermatids predominated), measured 60 mm SVL (NCSM 41323) and was from March.

It appears that in North Carolina male *P. inexpectatus* first come into breeding condition in April (Table 1) as 4/7 (57%) of the sample had commenced spermiogenesis. Males were reproductively active through May. I lack data to ascertain the month when *P. inexpectatus* males cease reproductive activity, how-

Table 1. Four monthly stages in the testicular cycle of 15 adult male *Plestiodon inexpectatus* from North Carolina.

Month	N	Regressed (1)	Recrudescence (2)	Late recrudescence (3)	Spermiogenesis (4)
March	2	0	1	1	0
April	7	0	0	3	4
May	3	0	0	0	3
June	1	1	0	0	0
July	1	1	0	0	0
August	1	1	0	0	0

ever, one male each from June, July, and August had regressed testes (Table 1). In North Carolina *P. inexpectatus* gravid females were found mainly from May to July indicating breeding occurs in the spring (Palmer and Braswell, 1995) as suggested by male reproductive activity (Table 1).

Events in the testis cycle of *Plestiodon inexpectatus* from North Carolina are similar to those of *P. gilberti* from California (Goldberg, 2009) and *P. laticeps* from Oklahoma (Goldberg, 2014) in which 85% and 100% of males, respectively, from May were undergoing spermiogenesis. In contrast, both March samples of *Plestiodon* (as *Eumeces*) *skiltonianus* (94%, 16/17) from southern

California (Goldberg, 2005) and *P. multivirgatus* (100%, 3/3) from New Mexico (Goldberg, 2012) had commenced spermiogenesis indicating an earlier start of male reproductive activity when compared to *P. gilberti*, *P. inexpectatus* or *P. laticeps*. The advantages of *P. skiltonianus* (Goldberg, 2005) and *P. multivirgatus* (Goldberg, 2012) males starting reproduction at an earlier time of the year are not clear and merit further study.

Acknowledgment

I thank Bryan Stuart (NCSM) for permission to examine *P. inexpectatus*.

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Appendix

Fifteen *Plestiodon inexpectatus* males borrowed from the North Carolina State Museum of Natural Sciences (NCSM), Raleigh, North Carolina, U.S.A., for histological examination of the testes, listed by county: **Beaufort** NCSM 30374, 30376; **Bladen** NCSM 15006, 15007; **Carteret** NCSM 41297; **Craven** NCSM 41320, 41323, 41467; **Cumberland** NCSM 13796; **Dare** NCSM 26692; **Duplin** NCSM 13983, 26695; **Jones** NCSM 14873; **Wake** NCSM 26704, 26707.

Pick Your Poison

Aquila Wilks
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Introduction

A lot of people flinch when I tell them what I do. Without getting into the nitty-gritty details, I'm effectively a herpetologist in training. I began as a volunteer at the Field Museum's Amphibians and Reptiles collection in 2013, doing everything from checking the alcohol balance in jars, to data entry, to using Pokémon to teach kids about the natural world. Recently I was hired by the museum as a collection assistant. The bulk of my herpetological work is done in the lab with dead specimens. Thank goodness the cobra I had to work with was a preserved individual; I am not yet experienced with venomous ("hot") snakes. Trying to identify the species of a live individual could be dangerous. Fortunately, a preserved snake is perfect when it comes to identification—a task which proved to be a much larger problem than I had initially thought.

There are few snakes more recognizable than an agitated cobra. You can ask anybody to draw a cobra, and they will probably get the vague outline of a hooded snake at least somewhat right. This ease of identification has a number of benefits; for example, in India, more people will get antivenin for a correctly-identified cobra bite than for a bite from another, less-distinguishable venomous snake such as the common krait (Jena and Sarangi, 1993). So, when I saw a specimen in a jar labeled as the Indian, or spectacled cobra (*Naja naja*), with the bull's-eye hood of a monocled cobra (*Naja kaouthia*), I had to see if there had been some sort of mistake.

"*Naja naja* sometimes have monocellate markings," my supervisor said. Using the hood marking isn't a 100% accurate way of identifying cobras, although it may come in handy when asked to describe the snake that bit someone in a non-lab situation. He encouraged me to look into it. Many books and articles later, I found that I was probably right about the specimen being a monocled cobra, and that this misidentification was a small piece of a much bigger issue.

It seems that both normal folk and herpetologists are unsure of exactly how many species of cobra there are in the world. While this would be understandable if we were trying to count the number of innocuous rat snakes in existence, it's baffling that several species of cobra might be going completely unaccounted for. They are one of the most charismatic and recognizable of snakes, yet the exact number of different cobra species remains up for debate. While most people may agree that the king cobra (*Ophiophagus hannah*) deserves its own genus, and that the African cobras are distinct from Indian and other Asian cobras, problems arise when one tries to determine if the Indian and monocled cobras are separate species. Older sources refer to all Asiatic cobras as *Naja naja*, not always with a subspecies name attached. (*Ophiophagus hannah* used to be among these before being placed in its own genus.) Most modern texts, however, either acknowledge the *Naja naja* subspecies, or give full-species status to some of them.

In his 1993 article "A Century of Confusion: Asiatic Cobras

Revisited," cobra expert Wolfgang Wüster cites nine distinct Asiatic *Naja* species: *Naja naja* (the spectacled / Indian cobra); *Naja kaouthia* (the monocled cobra); *Naja atra* (the Chinese cobra); *Naja oxiana* (the Caspian cobra); *Naja sputatrix* (the Javan spitting or Indonesian cobra); *Naja philippinensis* (the Philippine cobra); *Naja samarensis* (the Samar or Visayan cobra); *Naja sumatrana* (the Sumatran spitting cobra); and one close relative of the Chinese, *Naja cf. atra*, which resided between China and Vietnam and lacked a name. Wüster and Thorpe (1994) applied the name *Naja siamensis* (the Siamese cobra, one of three species in Thailand) to the form they had previously referred to as *Naja cf. atra*. *Naja mandalayensis* (the Mandalay cobra) native to the dry zone in Burma, was added as a new species by Slowinski and Wüster (2000). *Naja sagittifera*, the Andaman cobra, has been officially recognized as a species since 1995 (Wüster et al., 1995). That brings our total of Asiatic *Naja* species to 11. Although intergrades do occur, these forms are different enough to be regarded by the scientific community as definite *species*.

Traditionally, the hood has been used to identify cobra varieties. This is particularly so in India, where populations of the spectacled / Indian cobra (*N. naja*) and the monocled cobra (*N. kaouthia*) overlap. However, this becomes less reliable as the snake gets older; much like a design on a T-shirt, cobra markings fade with time (Smith, 1943). The monocled is particularly problematic, spanning a wide range, coming in a rainbow of colors, and having the hood marking in varying degrees (although never absent—at least in India). Wüster (1993) included a magnificent set of six photographs showing how variable cobras are, and how little the hood marking means when it comes to pinpointing the nature of the beast. It is nonetheless one of the most easily observable characteristics; herpetologists still use it as a major identifying marker, and in the event of a bite, it can be handy in describing the snake. Even saying that the hood is completely patternless is better than having no description at all. Combined with locality and other factors, the hood marking can still be useful. It is just far less useful by itself than previously thought.

There is also genetic support for there being multiple species of Asiatic cobra. Wüster and Thorpe (1994) tested the gene sequences of Thailand cobras using a gene called cytochrome oxidase subunit I (CO I). CO I is said to have a mutation rate fast enough to differentiate itself between different species, thus making it a good indicator that a species has split. The two researchers found not two, but *three* different species of cobra in Thailand, adding *Naja siamensis* to the two species previously known from that country (*N. atra* and *N. kaouthia*).

Why Does It Matter?

The acknowledgment and acceptance of several distinct species matters not only because it allows us to finally put the taxonomy problem to rest, but also because it affects conservation efforts and allows for the investigation of more effective

antivenins. Like vaccines, snake antivenins so far are *not* one size fits all. Different species require different antivenins, much like a vaccine for rabies will not prevent one from getting the flu. A cobra antivenin, by itself, won't work on a krait bite; the molecular structures of the venoms are simply too different. There's even a chance that cobras of the same species may have slightly different venom structures, but we know for sure that antivenins usually *don't* work across different species of snake. That includes the different species of cobra. The Thai Red Cross has possibly the most pluripotent antivenin to date in the making, with a 100% survival rate in rodents thus far (Nowogrodzki, 2016). For now, it is still better to bear in mind that we don't have a panacea.

This “*not* one size fits all” idea is shown clearly when testing the use of *Naja naja* antivenin on *Naja kaouthia* venom. In general, “it has been observed that the efficacy [of treatment] is highly reduced when antivenoms raised against venom from a particular geographic region is [sic] used to treat victims from another region” (Das et al., 2013). This is true for species as well as localities. Specifically, the dose of *N. naja* antivenin required to fully neutralize a *N. kaouthia* bite was ten times higher than that required to treat a bite from a confirmed *N. naja*. This diversity of *Naja* toxins, with their disparate effects on different victims, makes the lack of interspecific clarity in *Naja* particularly alarming.

The effectiveness of antivenin, however, is not the only easily observable difference between the members of the Asian cobra species complex. Notes about the difference in temperament between monocled and spectacled cobras (referred to as subspecies of *Naja naja*) appear in Jena and Sarangi (1993). This work describes the monocled cobra as “more virulent and aggressive than [the] spectacled cobra,” and reports that local farmers describe it as a cobra that will chase a person the distance of 2½ paddy fields. Yet accounts seem to vary. Wüster (1993) states that in Thailand, an area where the snakes are common, “monocled cobras are often handled like pet corn snakes” The point stands that different *Naja* species behave differently.

Jena and Sarangi (1993) describe the Indian cobra (which they refer to as *N. n. naja*) as docile and timid, enough so that locals keep them as pets, which do them no harm; they bite only when provoked. However, I have not found many accounts about keeping the Indian cobra in captivity, as is frequently done with the monocled cobra. This is probably because they are legally protected under the Indian Wildlife Protection Act; *N. kaouthia* in India is under this protection as well, but its range is so wide that a *N. kaouthia* can also come from Thailand, Malaysia or a number of other places besides India.

Putting It to the Test

I had my preserved specimen, catalog number 224204, codenamed “Blondie” for its yellow-tan coloration. What was needed was to determine if it really had been miscategorized. The first thing I did was look for comparison specimens in the collection. I grabbed a definite Indian cobra from India, and one that was labeled a monocled from Vietnam. Just to be sure, I chose ones that were around the same size as the specimen in question. Size should not matter when determining species, but

it is usually best to compare juveniles to juveniles, adults to adults, etc. The second thing I did was go book-diving. At the Field Museum, we have a substantial library on herps from around the world. I was encouraged to look at books and journal articles on the snakes of Thailand, which is close enough to Malaysia to have several species in common. It was here that I discovered that there was more to this particular issue than met the eye.

The Indian cobra *Naja naja* appeared in Southeast Asia-related books as the nominate species of all Asiatic cobras, if it appeared at all. *Naja kaouthia* would be referred to as a subspecies of *Naja naja*, as would be the case with nearly every cobra in the East. (The books also mentioned the Sumatran cobra, *Naja sputatrix*, which has similar classification issues.)

The first thing most books do is divide cobras by location. If the two populations are geographically isolated, they may well be different species. The Indian cobra is found in India and Sri Lanka while the monocled cobra's range spans a small piece of India (Assam, known widely for its tea), and then most of south-east Asia into China. Cobras are not capable of long-distance relationships unless humans give them a hand, so location alone should be a decent indicator of what snake we have.

Procedures

The specimen in question came from Perak, Malaysia, a locality nowhere near India. Except for maybe the odd snake charmer bringing his pet over, there was no reason for an Indian cobra to be so far away from its habitat. Textbooks may vary on whether it's a full species, but this specimen should have been *N. kaouthia* judging by location and hood marking alone. Geographical barriers can make or break a species. Although *Naja kaouthia* ranges into India (and therefore possibly intergrades with *Naja naja*), Indian cobras do not range into Malaysia. But for the sake of argument, what if some sort of importation occurred? Or what if that particular specimen was some sort of stray intergrade? Just in case, herpetologists have a few other ways to identify a snake of questionable species. Specifically, we use physical characteristics such as the hemipenes and scale counts to distinguish one species from another.

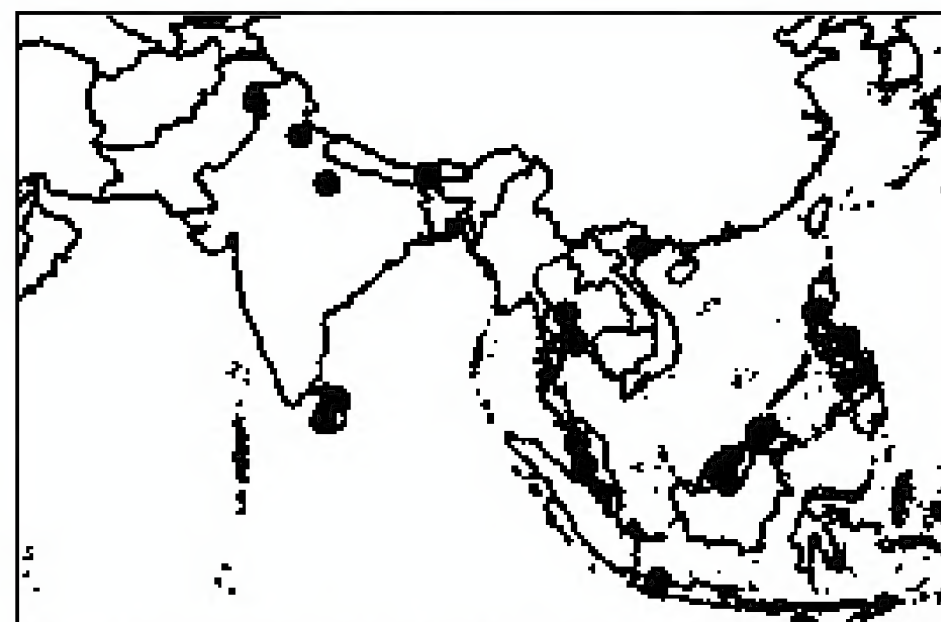


Figure 1. On this map the solid black circles indicate Field Museum specimens from India, Southeast Asia, Indonesia and the Philippines that are labeled as *Naja naja*. As some parts of India have *N. kaouthia* and *N. oxiana* populations, even being from India doesn't make for a bona fide Indian cobra (*N. naja*). Similar problems are common in many collections throughout the world.

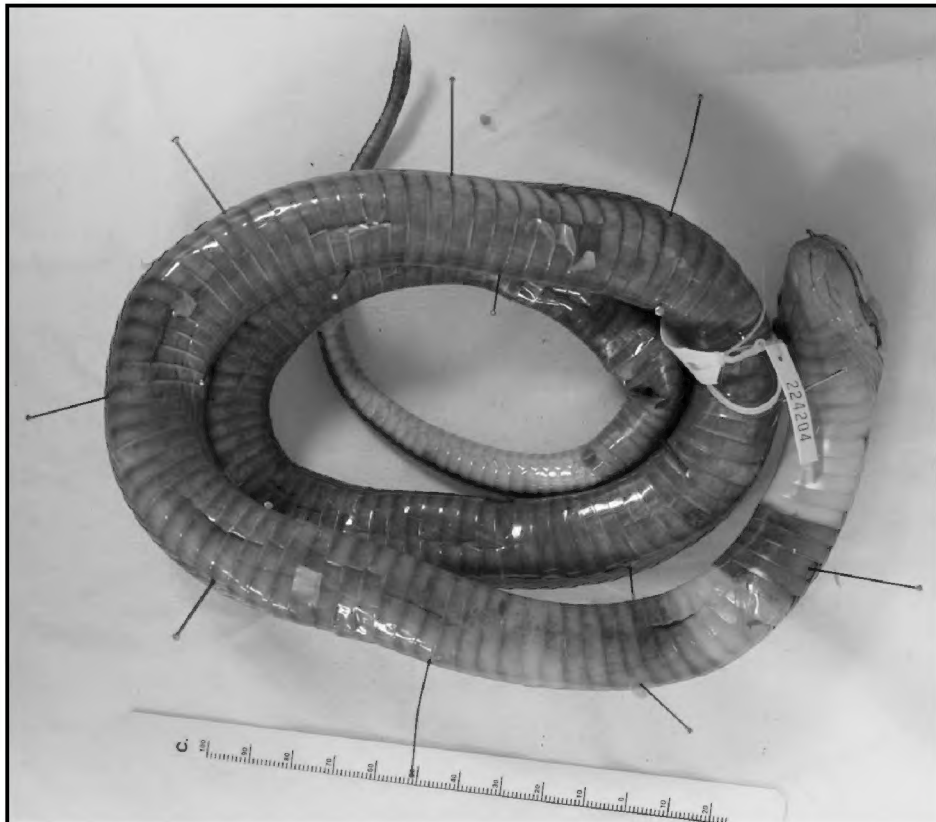


Figure 2. Prepared to count the ventral scales of FMNH 224204. Photograph by the author.

In this particular case, the hemipenes had to be ruled out; either our specimen was female (likely), or eversion with formalin somehow failed. Normally, these organs would be an identifying characteristic, but as they were absent, scale counting remained as the only reliable method of identification. Except for the tail, members of the same species have roughly the same number of scales on any given part of the body, which gives us plenty of areas to choose from when making an identifying count.

Books such as Leviton et al. (2008) gave ranges for various scale counts. Additionally, the books included descriptions of the nasal scales, supralabials, infralabials, chin shields, and various other terms that would confuse those of us unfamiliar with Latin. (Knowledge of dead languages can help you understand science.)

As you can see, we have options. We can count the head scales, chin scales, neck scales, ventral scales, midbody scales, subcaudal scales, and so on. Is the anal scale split? That's an identifying factor. Are the scales smooth or keeled? That's an indicator, too. The number of scales around the eyes can also be identifying characters. One must simply pick a body part and go.

Scale counting has to be done precisely, even if we have a range of scales to work with (as is the case of the neck and midbody on our cobras). Scale counting can be a tedious and even intimidating task. For example, on a cobra, counting neck scales is particularly painful. In preserved specimens, an

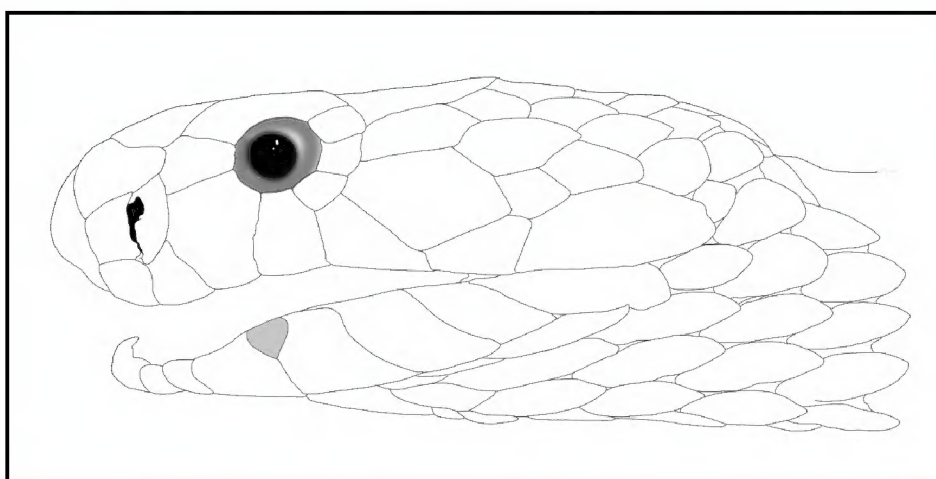


Figure 3. *Naja naja* (FMNH 171744), with single cuneate scale shaded.

unspread hood with wrinkles may hide extra scales. Thankfully, all other parts of the body on this specimen proved fairly easy to record. There are a few different methods of counting scale rows, but my favorite involves counting in a sort of V-shape: moving posteriorly, scale by scale, on a diagonal towards the spine, then back up the other side. The midbody count on Blondie, performed thus, was normal for a monocled cobra (21), and the markings also pointed to a monocled. In addition to the midbody scale count, I also completed a few counts in other areas. This included the numerous ventrals—the scales running along the underside of a snake between the head and the cloaca. Pins were used, every 10 ventral scales, to make counting easier. The end count was 173 ventrals. It's a good thing the lab let me use the pins; otherwise I probably would have lost count (Figure 2).

Despite everything pointing to this specimen being a monocled cobra, there was still something nagging at the back of my mind. Intuitively, I knew there had to be something that made the monocled cobra distinct from the Indian aside from pattern and geography. The scale counts fit into the ranges for a monocled, but not an Indian at midbody, and yet I still wanted more. I was looking for something else clinching between the two, a tiebreaker in case my math had failed me, and finally found it on Wikipedia (Anonymous, 2017).

Cobras, and only cobras of the genus *Naja*, have a scale on the lower lip called the cuneate (“cone-shaped”) scale. The presence of this scale is perhaps the *least* noticeable method of distinguishing the Indian cobra (*Naja naja*) from the king cobra (*Ophiophagus hannah*). It so happens, however, that this small, triangular scale is also a distinguishing factor between *N. naja* and *N. kaouthia*. Specifically: *N. naja* typically has only one such scale on either side (Figure 3), while *N. kaouthia* (Figure 4) frequently has more. This difference was mentioned in other references (Taylor, 1965; Wüster, 1998). Evidence on the Internet posted by an apparently daring photographer also confirmed its veracity (Kulkarni, 2011).

Sure enough, the lower lip on Blondie contained a lot more scales than on the Indian cobra I had pulled out of the collection, including two cuneate scales (and a scale between them) instead of one. If Blondie wasn't *Naja kaouthia*, she was at least *N. n. kaouthia*, and certainly deserved the distinction on her label.

Conclusion

Overall, identifying cobras was an enlightening experience.

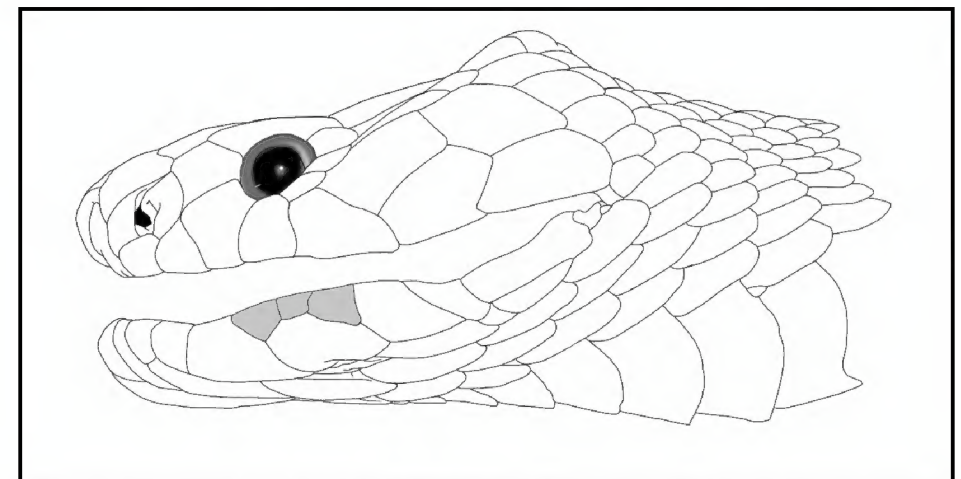


Figure 4. *Naja kaouthia* (FMNH 224204), with cuneates and scale between them (labial?) shaded.

Since hood markings in cobras may or may not be reliable, I needed a crash course on the methods used to identify preserved specimens in the lab. Both the hood marking and the locality where it was collected should have been useful in identifying Blondie as either *Naja kaouthia* or *Naja naja kaouthia*— whichever nomenclature for the monocled cobra floats your boat. Although scale counts may look daunting to people who haven't taken an actual course in herpetology, they nonetheless work, and there are tricks for making what seems like a Herculean task a lot easier. Blondie's eye-marked hood catches everybody's attention, and now we at the museum know she's a monocled cobra. Now for the other specimens.

Acknowledgments

Special thanks to: Alan Resetar, for helping me with the

resources and making me more and more curious; Rachel Grill, for doing the amazing facial scale diagrams; Wolfgang Wüster, for responding to my Tweets; and my mom, for encouraging my academic interests and putting brightly-colored toy cobras in my Easter basket one year, despite my brother thinking it more than a little strange. I hope to work more with these fascinating, beautiful, deadly serpents in the near future!

Specimens used

FMNH 224204 - *Naja kaouthia* (labeled *Naja naja*)

FMNH 259118 - *Naja kaouthia*

FMNH 171744 - *Naja naja*

FMNH 240528 - *Naja sumatrana?* (labeled *Naja naja*)

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A Note on the Distribution of the Eastern Musk Turtle, *Sternotherus odoratus*, within the North and West Branches of the Susquehanna River, Pennsylvania

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The Eastern Musk Turtle, *Sternotherus odoratus*, is a small (up to 15 cm straight carapace length [SCL]), aquatic species native to eastern and central North America, from Ontario and Quebec, Canada, south to Florida and west to Texas and Wisconsin, USA (Ernst and Lovich, 2009). Within Pennsylvania, *S. odoratus* occurs in a disjunct distribution, with records from northwestern Pennsylvania from waters draining into the Lake Erie and Ohio watersheds (Crawford, Erie and Mercer Counties) and records from multiple localities in the Susquehanna and Delaware River watersheds in eastern and central Pennsylvania (McCoy, 1982; Hulse et al., 2001). While a number of records exist for *S. odoratus* within the lower portions of the Susquehanna River watershed in Pennsylvania (McCoy, 1982; Hulse et al., 2001), few records appear to be available for this species upstream of confluence of the North Branch and West Branch of the Susquehanna River in the borough of Northumberland, Northumberland County, Pennsylvania.

Just below the confluence of the North and West Branches of the Susquehanna River, the nearest record for *S. odoratus* is specimen held within the Smithsonian Institution National Museum of Natural History (NMNH), collected at the Susquehanna River at Sunbury, Northumberland County (NMNH 26036; Hulse et al., 2001). Many other records have been reported from the watershed below this point (McCoy, 1982; Hulse et al., 2001), which are not discussed further here.

To my knowledge, within the West Branch of the Susquehanna River, three records have been reported for *S. odoratus* (Figure 1). An unvouchered record is depicted in Hulse et al. (2001) for Clinton County (a voucher photo for *S. odoratus* in Clinton County can be found on the Pennsylvania Amphibian and Reptile Survey website; www.paherpsurvey.org; confirming the presence of this species within that county, although detailed locality data are not available). Two other records for the West Branch include a record from Chillisquaque Creek near Potts Grove in Northumberland County (Carnegie Museum of Natural History [CM] 113393; Hulse et al., 2001), and a recent record from within the Chillisquaque watershed in adjacent Montour County (Hartzell and Pitt, 2015).

Recently, while examining herpetology specimens in the Bloomsburg University collection as part of a recent work, I noted a specimen in the collection of *S. odoratus* from Columbia County, Pennsylvania that was reported as a novel county record in Hartzell (2016). At the time, I did not recognize the additional significance of the specimen in that, to my knowledge, it appears to be the sole documented record of *S. odoratus* within the North Branch of the Susquehanna River watershed (Figure 1). The specimen, for which associated data records collection on 10 June 1976, is a juvenile measuring approximately 4 cm SCL. The turtle was collected in the canal remnants between Pennsylvania Route 42 and the Susquehanna River in Rupert,

Montour Township (approximately 40.970°N, 76.471°W). Presently, it remains within the uncatalogued portion of the herpetology collection. This specimen represents an extension of approximately 30 km from the nearest “down river” record for this species (NMNH 26036), and is located approximately 22.5 km SE of the record reported in adjacent Montour County by Hartzell and Pitt (2015).

Records for *S. odoratus* above the confluence of the West and North Branches of the Susquehanna River are few, likely suggesting that these regions are near the limit of this species’ range within the Susquehanna watershed. However, the fact that records are known from both the lower portions of the North and West Branch Susquehanna River drainages might suggest the occurrence of this species further up each respective watershed. Perhaps future survey work could search for *S. odoratus* in other portions of the West Branch Susquehanna River upstream of the mouth of the Chillisquaque Creek watershed between this and the unvouchered record for Clinton County reported by Hulse et al. (2001), as well as upstream of this record. Surveying lentic habitats associated with the remains of the North Branch Canal system along the North Branch Susquehanna River might reveal *S. odoratus* along this stretch of the river in other portions (upstream) of the Columbia County record in Columbia County, and possibly extend its range into Luzerne or Wyoming County.

Acknowledgments

I thank Clay E. Corbin for allowing me to examine herpetology specimens in the Bloomsburg University Natural History Collection.

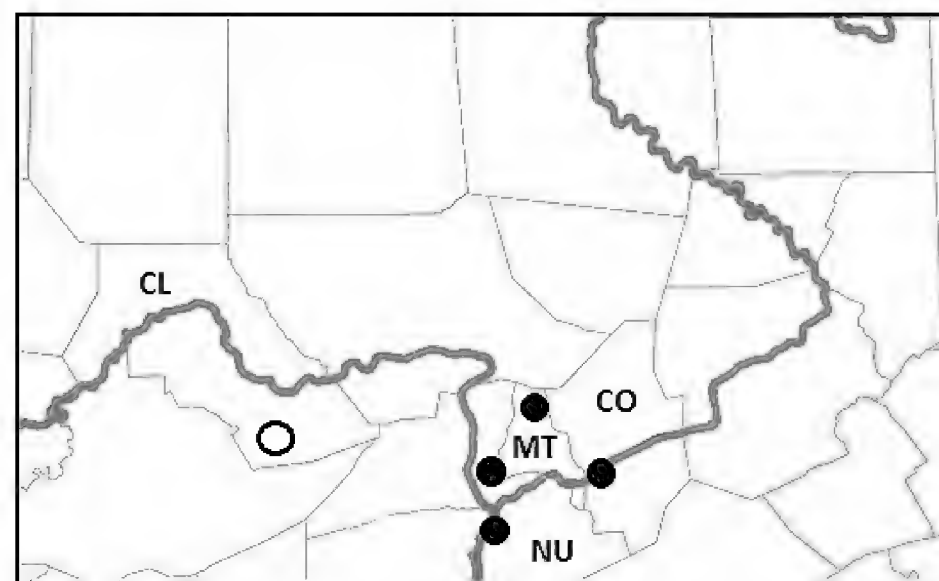


Figure 1. Distribution records for *Sternotherus odoratus* in the North and West Branch Susquehanna River, Pennsylvania, with the nearest record downstream of the Northumberland confluence for context (NMNH 26036). Records represented by voucher records are depicted by closed circles, and an unvouchered sight record from Hulse et al. (2001) is depicted with an open circle. Records not depicted within the Pennsylvania range map for this species in Hulse et al. (2001) include records from Columbia and Montour Counties. Name abbreviations for counties with records are as follows: CL: Clinton; CO: Columbia; MT: Montour; NU: Northumberland.

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A Little about a Lot: Lyresnakes, My Way!

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On four occasions throughout my avocational career as a field herpetologist, I wound up among people who were trying to remove a Sonoran Lyresnake (*Trimorphodon lambda*) from the rock crevice in which it had been found. The first three occurrences of this errant behavior were initiated by somebody other than me. All three attempts were made by people who knew better than to do such a thing on a Roger Repp study plot. In all three cases, those who performed the misdeed did so simply because the lustful contain-and-restrain instincts of a dyed-in-the-wool, real-deal herpetologist manifested at a bad time, and overcame all rules governing common sense. After all, what does a serious tongue-lashing from an irritable herp king matter when the opportunity of containing and restraining a wild lyresnake presents itself? In all three cases, the snakes had been under watch for more than two years. In all three cases, they were returned to the cracks whence they came. And none has ever been seen again in the crevice in which it was disturbed.

The last time that this happened is on me. The date was 13 March 2010. Herpetologist and author Kate Jackson was visiting Tucson from Whitman College in Walla Walla, Washington. Among other things herpetological, Kate wanted to see a Chuckwalla (*Sauromalus ater*) in the wild. In order to magnify our odds at finding not only a Chuckwalla, but many other herps as well, I invited a gang of three others to join us. Dale DeNardo and Mike Angilletta met us at a prearranged location, and Robert Villa joined Kate and me for the ride north to meet them. It goes without saying that this author found the only Chuck of the day, and was gleefully dancing around the countryside while shouting praises to his own prowess following the great feat. This behavior was immediately censured by DeNardo, who moments later, found a *dandy* lyresnake coiled under a hefty chunk of caprock, directly above my Chuckwalla. Any time since that day that DeNardo feels like belittling me—which is often—he reminds me of the day that I was dancing around and acting like an idiot while he was finding a lyresnake. That’s what friends are for! As Kate and Mike were both visitors to our state, we decided to lift the chunk of caprock so that they could hold and photograph the lyresnake that Dale had found. The

caprock was hefted upward, the snake was snagged, and we all took turns with the felonious snake-fondling and photography that always follows an event such as this. To her credit, Kate got the money shot (Figure 1). We put the caprock back on its moorings, taking pains to make sure it was perfectly aligned with its pre-capture position. The snake was then released—and seven years later, has never returned.

I am now four-for-four when it comes to losing, apparently forever, the thrill of watching a lyresnake in a crevice where the lyresnake is disturbed by any form of human interaction. In my opinion, these fabulous snakes are *much* too difficult to find to risk squandering an opportunity to see them on a regular basis by messing with them for any reason. As one who would know exactly what to do to satisfy the requirements of science with any formal study on lyresnakes, I am unwilling to pay the price for doing so. I am content to keep watching those that I have already found. I am content to try to continue to find more. And I am content to do the best I can with good notes and a camera for identifying individuals in the years ahead. I am *not* content with the results that the camera has given me thus far in this regard, but I know that I will do better with future opportunities.



Figure 1. A Sonoran Lyresnake (*Trimorphodon lambda*) posed for the money shot. Image by Kate Jackson, 13 March 2010.

On the other side of the research equation, the King knows PIT tags, the King knows transmitters, and the King knows how to collect, keep and synthesize *piles* of data. But based on the zero-for-four success ratio at observing a lyresnake returning to its crevice following a disturbance, the King also knows there has to be another way. And whether whatever I do next is done to satisfy the strict requirements of science, or to satiate my own burning desire to learn everything I can about this fascinating subtropical snake species, neither result will *ever* put one scrap of food on my table. To quote Ricky Nelson: “You can’t please everyone, so you got to please yourself.” With my retirement right around the corner, I look forward to embracing whatever secrets lyresnakes will reveal to me in the years ahead by doing this thing my way. That means anything else might fly, but there will be no more yanking them out of crevices!

As not a one of you will remember (no worries—neither did I), my last column centered on the excitement of finding a place that we call Iron Mine Hill, and the promise of further elucidation on two lyresnakes that were found there. I don’t know how any of us could *not* be absolutely agog with excitement over these lyresnakes. The promise of more incoming information on them must have left you on the edge of your seat. Have you been running to the mailbox every day, seeking release from the overpowering angst welling up in your knowledge-thirsting soul over these two snakes, only to be crushed when your copy of the *Bulletin* did not arrive? Well, dear reader, today is indeed your lucky day! That which you sought is in your hands, the nightmarish wait is behind you, and in less than half an hour, you will know *everything* that I know about these two lyresnakes. (And you *still* won’t know anything about them.)

It is probably best to chew some of my intellectual cabbage twice, in order to clear my gullet for the projectile vomiting of information that is about to transpire. Hence, we back the train up a bit, and review some of last month’s article. Much of it dealt with an upcoming anniversary celebration—which appears to have happened without me. (Leave it to herpers to forget an invite to the guest of honor in such affairs.) Also discussed were the seven fundamental rules for selecting a long-term herp spot. Proper sequencing was delivered in artful form, as rules number 1 through 6, whatever the heck they were, were presented in proper chronological order, and preceded number 7. Number 7 *must* have been the biggest, because the article said so, and I quote: “Roger’s Rule #7 is the biggest [see what I mean?] The place has to have herps deemed cool and watchable.”

The paragraph that followed this statement dealt with the consummation of rule #7 that occurred on 1 November 1992—my third visit to Iron Mine Hill. Said paragraph went as follows:

Within ten minutes of emerging from the vehicle, two Sonoran Lyresnakes (*Trimorphodon lambda*) were found in separate boulder crevices. The words “cool” and “watchable” apply to such finds as lyresnakes to this herper. They are cool because they are snakes, and they are watchable because once one finds their lairs in late fall, one can count on seeing them multiple times throughout the winter and early spring. And there is also a strong possibility that once they leave their crevice in the spring, they will return the following fall. In short, a lyresnake in a crevice can provide years of entertainment.

And now that we are back to live action, would you believe that “the years of entertainment” discussed about one of the lyresnakes above amounted to *twenty-three years*? I want the reader to cast his or her eyes at the three images stacked on top



Figure 2. See text for details.

of each other in Figure 2. You will note that there is no caption with the image—other than “see text for details.” The text that you are to see the details in follows immediately.

Figure 2. Top: Photograph of the second lyresnake crevice (IMH#2) first found on 1 November 1992. This image was taken by Daniel M. Bell, on 7 November 1992. Middle: A lyresnake found and photographed by author in IMH#2 on 2 December 2006. Bottom: A lyresnake found and photographed in IMH#2 by author on 17 October 2015. The reader is seeing a 23-year spread of a lyresnake in a crevice. It is it the same snake? You’re seeing what I’m seeing—can you tell me? The author can’t say with any sort of assurance that this is the same snake. Nor can he say with any degree of certainty that it is *not* the same snake. The only certainty is that the rock crevice in this photo, which has been named IMH#2, is the same one in all three cases.

And now, I ask the readers to cast their eyes on Figure 3. We’re going to do the exact same thing with the caption for this one as we did with Figure 2. Here are the details: Photograph of IMH#2. This is the crevice of the lyresnake pictured in Figure 2. The author can’t prove that the lyresnake is the same individual throughout the 23-year time period under discussion, but the narrow crevice that angles across the top third of the boulder in this image is the same throughout. Hence, the crevice receives the identifying number, not the individual or individuals that inhabit it. Image by the author, 30 June 2017.

See also Figure 4. The last time a lyresnake was viewed in IMH#2 was 31 October 2015. But the fun continues well beyond that. Top: Image of lyresnake in IMH#2, taken by the author on 17 October 2015. Note the shed skin to either side of



Figure 3. See text for details.

the snake. Neither the snake nor the shed skin was visible during a visit made one week earlier. This allows for an approximate date—within 6 days, of the shedding event. Bottom: Image by the author, 30 June 2017. The lyresnake is not visible, and likely not home, but the shed skin remains largely intact. By determining how long it takes this shed skin to biodegrade, the time of crevice occupation by other lyresnakes can be estimated with the shed skins that are often found in other “perfect” lyresnake cracks. The author was not joking when he said a lyresnake crevice can provide years of entertainment. Who needs Disneyland when one has lyresnake cracks to watch?

Everything in this narrative that appears above, and some of what was written below, was written *before* I did something that needed doing. Up to the beginning of this paragraph, I was able to piece together most of the history on the first two Iron Mine Hill lyresnakes found simply by going through my lyresnake images. So far, so good, right? But by doing that something that needed to be done, I unwittingly destroyed any chance of writing a short, definitive article on Sonoran Lyresnakes.

I have a cardboard box that resides in a hallowed location in my office at home. The box is roughly 14 inches square by 12 inches tall. Within that box is every field notation that I have ever made on herpetological field trips that I have embarked upon. These field notes go back to July 1989. There are nearly 4,000 field trips covered by these notes, and over 20,000 hours of personal field hours of effort. Along with my personal 20,000 hours of effort, 20,000 hours of the efforts of other people are also recorded in these notes. Whether I found something cool, or other people found something cool, it was written down in these notes. What I did was pull every note I’ve ever written out of that box, with the intent of looking up every shred of information about the first two lyresnakes found on Iron Mine Hill. When I first started the mission to go deep with these two lyresnakes, it was my intent to only focus on those two snakes. But right from the start, that mission grew. Why only go for two, when I could go for them all?

To do the job as thoroughly as possible, I created a spreadsheet with eight different column headings. These were Individual Number, Sighting Number, Location, Date, Estimated Size, Activity, Crevice Orientation (for those in crevices), and Comments. What I did was plunk my stack of field notes down in front of me, and ferret every wild lyresnake that I have ever seen

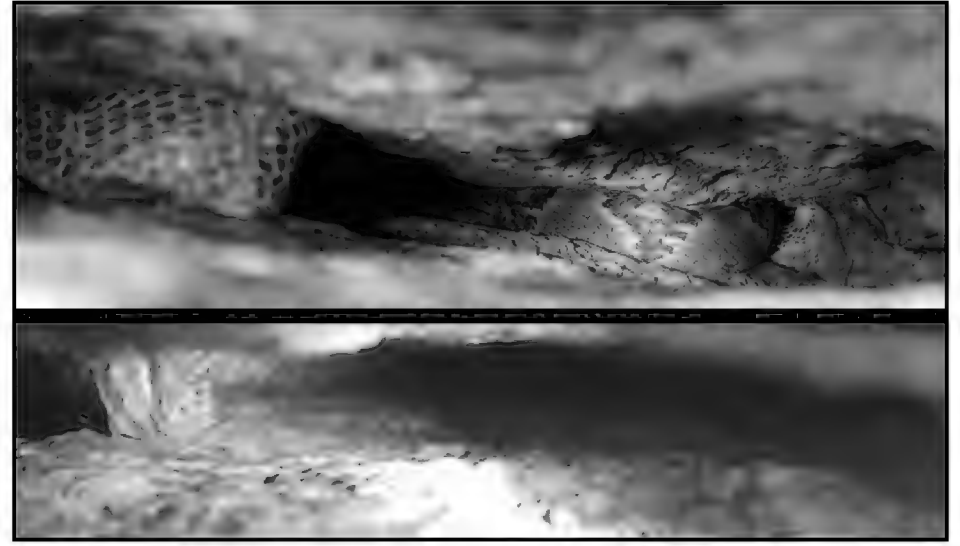


Figure 4. See text for details..

out of said notes. I went through every herpetological field trip over a 27-year time period, and dutifully logged in the eight criteria for every fricking lyresnake found! It was a hell of an effort, but one that grew more interesting with every turn of the page. It took me three weeks to complete the process. And now that they are all logged on that spreadsheet, I feel like the proverbial dog who has finally caught the car that he was chasing. I don’t know what to do with it! I am looking at this staggering pile of data, likely the most overpowering dataset ever accumulated on a species of lyresnake, and I realize it is more than I can handle for this particular column. I’ve got a long way to go, and a short time to get there!

The best way to proceed for this particular column is to say a lot about a little, and a little about a lot. In the end, I hope to combine my data with whatever other solid data may be already published and/or in the hands of other people. This will take time—a lot more time than the three days that I have to get this column into our editor’s hands. For this column, I will start with a lot about a little by saying that memory is a quirky commodity. The better that we think our personal memory is, the more dangerous we become. I happen to think that my memory is good—better than most, even. No brag, just fact! But prior to writing this article, my memory of events surrounding the two Iron Mine Hill lyresnakes found on 1 November 1992 is one thing, reality is another. If I had reported what happened through the years with these two snakes based on memory alone, I would have regaled the reader with mythical stories of dozens of observations per year, and multiple years of site fidelity for each. Had I reported these things relying on memory, it would not have been a deliberate lie. It would have been a simple case of misremembering. As it turns out, my memory and reality *are not even close* to each other! The reality is that I have seen the first of the two lyresnakes (IMH#1) exactly 10 times through the years. There was the first visit, and another almost a week after, on 7 November 1992. Thankfully, my friend Dan Bell was with me for that second visit, for he took a photo of this snake in the crevice. (I did not start carrying a camera into the field until 1994.) Despite visiting that crevice many times in the years that followed, I did not see a lyresnake there again until 20 November of 1999—seven years later! I saw a lyresnake there twice in May of 2001 (late spring sightings are highly unusual), and then five more times in November of 2001. Despite hundreds (yes—*hundreds*) of visits since, I have never seen a lyresnake there again!

The second lyresnake (IMH#2) was not much more generous with the visuals. I saw it a total of 14 times through the years.



Figure 5. We count 'em all—even the dead ones! The cause of death is highly speculative, but the date this one was found was 4 September 2002. The year 2002 has been universally heralded as the year the current worldwide drought began. If ever there was a snake picture that could be used to show the devastating consequences of drought, this one might do it. Image by the author.

Like IMH#1, it was still visible with the second visit, and Dan Bell got the photo that you see in Figure 2. The next time I saw a lyresnake there was on 2 June 1993. From that point on, observations were sporadic. There was a five-year streak and a nine-year streak where I did not see a lyresnake there—again, with literally hundreds of visits. As Figures 3 and 4 have revealed, I continue to monitor IMH#2, and am approaching my second full year of not seeing a snake there. I visit Iron Mine Hill roughly 50 times a year. It is my favorite place on the entire planet to visit, and IMH#2 is so conveniently located to our parking spot that it would be blatantly stupid not to peek inside with every visit.

We will consider this round one of “a lot about a little,” and will close this column out with more of the same. For now, we deal with “a little about a lot.” As I began gathering the information from my notes, I dealt with a lot of uncertainty when it came to counting the lyresnakes as individuals. In the early days of finding them, I did not even have a camera, let alone have the ability to get good photos of the snakes found. I soon gave up on the notion of trying to separate the fly scat from the pepper when it came to counting the individual snakes. But one thing that I was 100% drop dead certain of was the number of sightings that I had on these snakes. If I approached a crevice and there was a lyresnake observed in it, it counted as a sighting. That means that whether it was a crevice known to contain a lyresnake or not, if I saw a lyresnake there, it was counted as a sighting. A good example of what this means has already been discussed. A lyresnake was seen 14 times in IMH#2. There may have only been one lyresnake in the entire history of IMH#2, but the number of sightings there would be 14.

Having said all that, my total number of lyresnake sightings through the years is 384. Of all these sightings, only 35 of them, or 9%, took place outside of a rock crevice. What this tells us is that if we weren't actively seeking them in rock crevices, we would not be seeing very many. Of the 35 surface-active individuals, four were found DOR on pavement. One was found freshly dead, coiled beside a log along an ATV trail—likely clipped by a vehicle. One was found dead—seemingly of natural causes—hanging out of a crevice (Figure 5). Fifteen were found

during nocturnal road cruising; five more were found arboreal in bushes and trees while we were night hiking, and nine more were found either climbing boulders or moving across rocky terrain while we were night hiking. Of those found surface-active outside of any crevice, only two *might* have been moving by daylight. The first of these two possible day-trippers occurred on 8 March 1995. I peered into a known lyresnake crevice in the morning, and did not see the snake. When I returned later in the day, I found the snake in the act of crawling into the crevice from the outside. It *may* have been outside the crevice with my first visit, and returning with the second. The other possible diurnally active snake was a very fresh DOR that was still in the throes of reflex motion at 1706 hours on 21 July 2000. The fact that I have to reach so hard to find these two diurnally active lyresnakes out of the 384 sightings points to them being *hugely* nocturnal when surface-active. But most of the snakes found in crevices were by daylight, and it is impossible to recall a scenario where they weren't alert and very aware of my presence. They may not be on the crawl much by day, but that does not mean that they are not vigilant then!

Through the years, 14 different crevices have been found that yielded lyresnakes on Iron Mine Hill. Seven of these 14 crevices were found before the radio-telemetry study began in March of 2001. The remaining seven were found during the 15 years that the telemetry study lasted. That is not a whole helluva lot of lyresnake crevices! I have often been asked “How many cracks do you look in for each lyresnake that you find?” This is a great question, the answer to which has been sought with a high degree of apathy. In short, I have tried doing this “counting crevices” nonsense a total of five times. Each time, I get to 30 or so before I reach the understanding that I really don't give a rat's ass enough about the answer to go through the effort that it takes to count every fricking rock crevice that I look into. What a butcher shop for the brain that is! But we *can* easily get a minimal number by estimating what happened during the radio-telemetry study years at Iron Mine Hill. For 15 years, we visited Iron Mine Hill at least twice a week, or more simply put, 100 times a year. With each and every visit, I can promise the reader that at least one potential new lyresnake crevice was checked. (Let me assure the reader that actually a lot more were checked per visit.) But sticking with just one crack per visit checked for 1500 visits, we found seven new lyresnake crevices, or one winner for every 214 duds. That ratio, one success for every 214 duds, seems high to me, but since I am aiming for a minimal possible success ratio, we go with it. Now you all have it, one lyresnake for every 214 looks, and I didn't even have to use all 21 of my appendages to get to that answer. If you want a better answer—go count cracks yourself!

Nine other lyresnakes were found surface-active on Iron Mine Hill through the tracking years. All nine were active nocturnally. One was found in May, one in June, four more in July, and three in September. The three that were found in September were all less than 350 mm in length, small enough that all might have been hatchlings. All size estimates are just that—I have never once actually formally processed a lyresnake. Having said that, the estimated range of sizes of the surface-active snakes range from 200 mm to 1200 mm in total length (8 inches to 4 feet). Two of the nine snakes found were arboreal, both roughly 1 meter off the ground. One was in a wolfberry, the other was in a hackberry, and both of these tree-huggers were pushing the

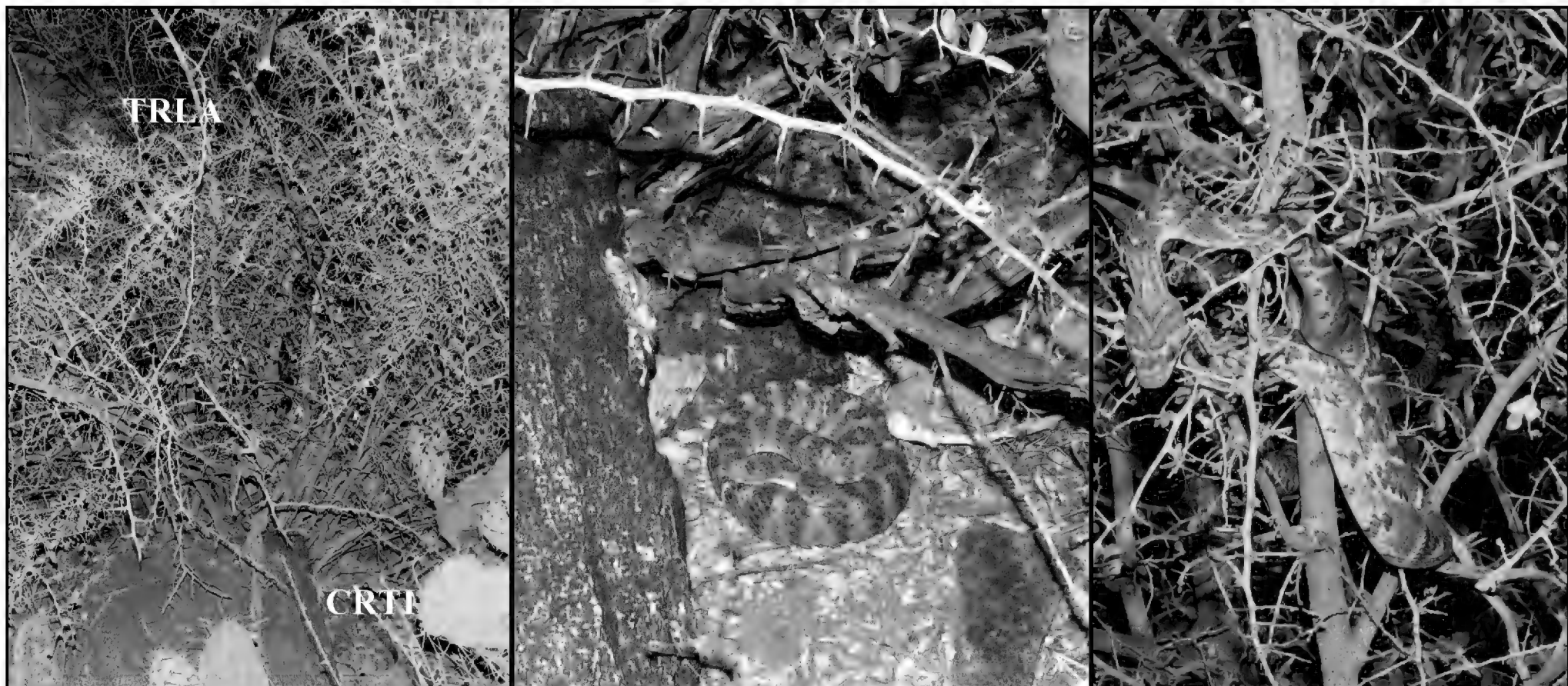


Figure 6. (Left): In situ image of a Lyresnake poised a meter above a Tiger Rattlesnake in a hackberry bush. The snakes are both directly beneath their abbreviated Latin nomenclature. (Center): Female *Crotalus tigris* #13, “Katey” seemingly unaware of what looms above. (Right) Large adult *Trimorphodon lambda* surveys the scene below. Images by the author.

upper limits size-wise. The one in the hackberry was poised directly above one of our radio transmitted Tiger Rattlesnakes (Figure 6). With but nine active individuals and 14 others (more or less) in crevices, the number encountered on Iron Mine Hill over the course of the 25-year period under discussion might lead one to deduce that they are rare there. Actually, their numbers stack up favorably when compared to other snake species in the vicinity. The only snake to top them by a landslide numbers-wise would be the Western Diamond-backed Rattlesnakes (*Crotalus atrox*). We processed a total of 24 Black-tailed Rattlesnakes (*Crotalus molossus*), 27 Tiger Rattlesnakes (*Crotalus tigris*), and 29 Gila Monsters (*Heloderma suspectum*) during the same period. Probably the best snakes to compare lyresnakes to in this regard would be Gophersnakes (*Pituophis catenifer*) and Coachwhips (*Masticophis flagellum*), but I have not yet separated these two snake species out as to how many have been found on or around Iron Mine Hill. Perhaps the next time I want to spend three weeks driving myself crazy, I’ll take that chore on. We have only found four each of Spotted Nightsnakes (*Hypsiglena torquata*) and Glossy Snakes (*Arizona elegans*), and only three Long-nosed Snakes (*Rhinocheilus lecontei*) through the years here. The total number of 14 overwintering crevices found on Iron Mine Hill doubles anyplace else that I routinely seek them.

And now, we will go back to these 14 crevices that we have monitored through the years, and pick off some of the highlights. I was once told that a perfect crevice would always contain a lyresnake. My retort to this at the time was that the only way a crevice could be deemed perfect would be *if* there was a lyresnake in it. But putting the wisecracks about perfect cracks aside, there is a common thread running through all 14 of the Iron Mine Hill crevices. Said common thread is that they are tight cracks, not gashes. One would be hard pressed to find even a short section of crack taller than 19 mm ($\sim 3/4$ inch) in any of the 14 Iron Mine Hill lyresnake crevices. This tight-fitting phenomenon also universally extends to the overwintering shelter sites beyond Iron Mine Hill as well. It seems to be the most important feature, as it is the only thing they all have in

common. The size of the boulders these crevices reside in range from the size of a wheelbarrow payload to larger than a pickup truck. Five of the crevices are horizontal, five are angled, and four are vertical in their relationship to the ground beneath them. Four of the crevices face west, five face southwest, three face south, and two face due east. Thirteen of the 14 cracks run deep enough inside the boulder that the snake or snakes residing within can get out of sight of the observer. The one where the snakes *can’t* get out of sight is the one that has taught me the most about lyresnakes

We shall revisit that crevice, along with the 13 others on Iron Mine Hill, with a column in the near future. I have already started writing that column, but I don’t wish to keep both of my loyal readers on the edge of their seat again by issuing any promises. I want to keep my options open for next month. As for the closure for this column, I feel compelled to say that thus far, I have gone to two other people whom I barely know. I contacted them because some of their herpetological work has centered on lyresnakes. As suggested, I barely know these two people, yet with each of them, our email conversations were such that I don’t think any of us got anything else accomplished for a week! Once we got started, we could not stop! Such is our fascination with a snake that is rear-fanged, and yet constricts some prey items. They *are* climbing fools — and rare is the desert snake that uses the third dimension of terrain as part of its survival routine. Their wiry body strength is amazing, and their ability to hold 90% of their body straight out into the air with but a minimal tail wrap to support them is unique among temperate snakes.

I look forward to working with lyresnakes in my retirement years. I hope to get better at identifying individuals with more thorough field notes and better camera work. I also look forward to writing more informative articles about them. Until that can happen: This here is Roger Repp, signing off from Southern Arizona, where the turtles are strong, the snakes are handsome, and the lizards are all above average.

What You Missed at the June Meeting

John Archer
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Our June meeting feels more intimate than others. It's a little like showing off your latest acquisition or your favorite animal to one of your friends when they've dropped by your house. Your friend ooohs and aaahs, asks questions, and shows interest that is usually beyond the average person's curiosity. It's great to get to know our speakers, but the up close and personal with our speakers happens before and after their presentation. The June meeting is a convivial group of like-minded people swapping info and anecdotes accented by live animals. Who doesn't like that?

So, after some brief business and the raffle (one of the prizes was a brand new 50-gallon breeder tank with lid donated by ZooMed!), our vice-president Jessica Wadleigh started the main event. She introduced Jason Smith with his pretty little reticulated python. Of course "little" is relative and his albino tiger retic looked to be around six or seven feet. As the snake calmly moved over him, Jason gave us a brief history of tiger retics, at least since 1993 when he first became involved. He mentioned the problems with temperament of the wild caught retics of that time and gave us a little background into the history of breeding morphs, throwing out terms like lavender and super tiger, dwarfs and super dwarfs, and \$75,000. Frankly I'm not particularly interested in morphs and breeding, but Jason talked just enough to be informative and interesting. I've certainly changed my opinion of retics, which he considers the "Rolls Royce" of snakes. I doubt I'll ever own one, but if I do, I'll be sure to take his advice, study the different breeds, and get one from a responsible breeder.



Jason Smith holds his albino tiger retic.

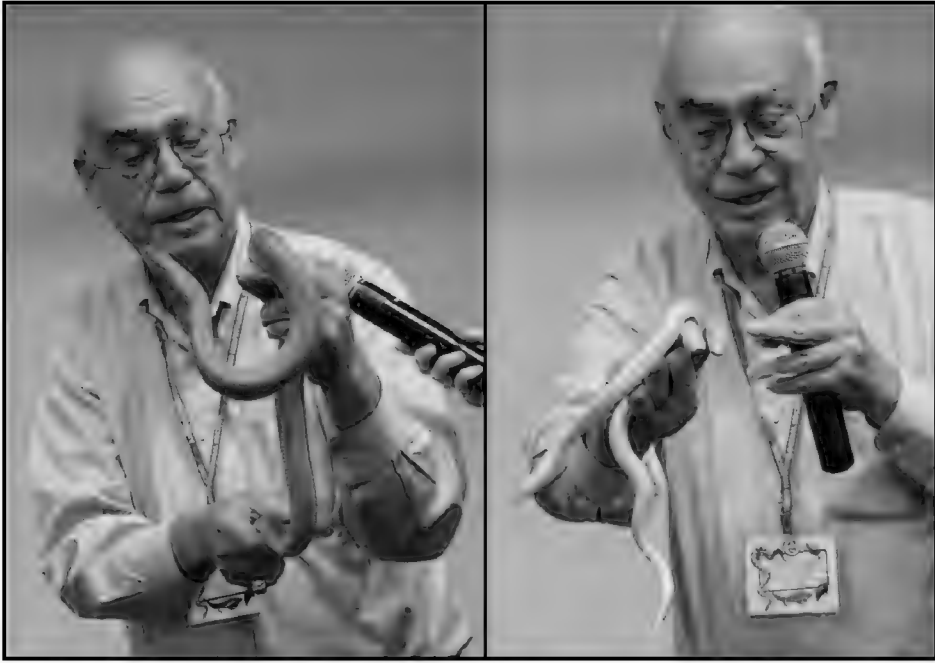
Next Nancy Kloskowski showed two snakes born August 10, 2016, to a "nasty" female Everglades rat snake and a Florida rat snake. The female laid seven eggs, they took 63 days to hatch, six babies lived and one died in the shell. Four she has adopted out, but she's kept two. She's named them after two "long deceased uncles" Henry and Chester. Not bad names for snakes, I think.

Mike Dloogatch held up what he called a "drab" rosy boa, but I didn't think it was drab. I admit I think all rosies are neat. Mike acquired this female at the August 2011 meeting that offered a large number of rosies for adoption. Mike said he doesn't normally adopt, but there were so many snakes that needed a home he offered to take one. To reward his kindness, in November of that year the female gave birth to five young, four of which were normal and one (here he reached into a snake bag and extracted an...) albino. While he obviously likes both snakes, Mike doesn't name his snakes. Neither do I.

Kevin Toberman held up both of his Mandarin rat snakes, one of which we saw last year. It's always nice to see the progress of animals brought in more than once. One of the youngsters was darker than the other and Kevin theorized that they may be from different localities, but the animals are highly variable and he doesn't have specific info. He said that these snakes have a wide distribution over southern China, Myanmar, Vietnam and Taiwan. Early imports were mainly snakes that had been captured for Asian food markets. They had been treated roughly and were very sickly. But captive breeding has been successful and healthy specimens can now be purchased. Kevin is hoping that both snakes will develop the bright yellows characteristic of the adults. While the snakes seemed comfort-



Nancy Kloskowski shows the results of an interesting cross breeding.



Mike Dloogatch with mother and offspring.

able with handling, Kevin mentioned that he regularly gets bitten because they are very cage defensive. Both of the snakes were female because Kevin doesn't want to breed them.

Frank Sladek has had an eastern painted turtle for 30 years, and he swore he would never get another aquatic turtle because they are so much work. But then (how often those two words equal another animal for us) his old chemistry teacher had a 20-year-old razorback musk turtle that "didn't play nice" with others. It had taken a chunk out of the teacher's 36-year-old painted turtle. Frank checked with friends and acquaintances and found no takers, not surprising with aquatic turtles, so Frank



Frank Sladek has a relationship with a razorback musk turtle.



Kevin Toberman holds two Mandarin rat snakes.

is now "fostering" the animal. Razorback musk turtles are relatively common and one of the smaller turtles native to south-central U.S. Frank calls his turtle "The Colonel" because he looks grizzled. The Colonel displayed his grumpiness by trying to bite Frank's fingers. In spite of that, Frank is planning on a 30-year relationship.

Zac Oomens had to be cajoled into presenting his little two-year-old Savannah monitor, and reluctantly stood up front and spoke. Most of Zac's talk seemed to be taken by listing what the animal would eat, best summed up by "anything." He did throw in that they get to be 3½ to 4 feet long, and that this one had a pretty nice temperament, which we could see. The audience seemed to think that Zac needed a name for the lizard, but as far as I know, none was selected that night.

Ben Podolske returned with his three-toed box turtle that he



Zac Oomens looks like he's proud of his savannah monitor.



Ben Podolske's three-toed box turtle looks happy.

acquired from a friend. With Joan Moore stepping in as MC, we learned the little animal was kept in a large aquarium not filled with water and with the help of Joan and the audience the turtle's sex was determined to be male.

Cleo the butter motley corn snake was lovingly displayed by Gail Allinson. She regaled us with the story of that particular morph, said that the snake was almost two years old, weighed 238 grams, and was 3 feet, two inches to four inches long (exact length being somewhat difficult to determine for snakes.) She has another corn and she keeps both in large Exoterra vivariums. Cleo hatched on August 28, and Gail says that both of her snakes are "sweethearts."

Leona Neusner held a little Mexican black kingsnake while she explained that they are native to Sonora, Mexico, and found in dry deserts or grasslands. They're born with white speckles that gradually disappear as they grow to 3-4 feet and turn jet black. They can live 20-30 years and while some are nippy, hers is not. She got the snake just last May and says she overpaid for it but was having a hard time finding one so didn't begrudge the payment.



Leona Neusner talks about her Mexican black kingsnake.



Gail Allinson shows off the beauty of her corn snake.

Bob Bavirsha married his high school sweetheart over 40 years ago. She bought him a baby snapping turtle that he still has. Bob thinks he must be doing something right because he still has both the wife and the turtle. He didn't bring that turtle, but he did bring one of the many rescued turtles that he receives. Bob says that one problem with snappers is "They don't do well with anything else in their cage." They tend to eat everything else. As he held it up, he showed us the plastron. Bob said that the turtles are grumpy because they have to fit all that meat into a "thong bikini." They can't bite through a broom handle (he's tested that) but could take a finger and they have a good sense of smell. He admonished us not to release captive animals in the wild and don't pick them up by their tails, and reminded us that turtles are long lived (he's willed his to his son). Snappers probably are the most common turtle consumed by humans in the U.S. but in spite of that, they seem to be in every permanent piece of water. An archaic looking creature seemed to be a good way to end the night.

As always I learned new stuff and was fascinated by the many ways that people approach this hobby of ours. I have never weighed one of my animals, don't name them, am indifferent to morphs (OK, piebalds attract me), don't breed snakes, and would not own a snapping turtle, but some of us do. We all have our individual ways of approaching these animals, and all can be interesting. And that's what makes June meetings fun. Next year we ought to serve drinks.



Bob Bavirsha tries to get someone to adopt a snapping turtle.

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For sale or trade: Probable pair of albino Harquahala rosy boas. They were born in my home in late 2016 and are feeding on f/t peach fuzz mice. Pure locality animals exhibiting a recessive gene. Viewing is possible, parents on site. I can drive to meet a reasonable distance, or ship if you are not local. Discount if you pick them up from my home. Cash, credit card or PayPal. Call or text 510-318-1715, or email elenabmoss@gmail.com.

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Line ads in this publication are run free for CHS members — \$2 per line for nonmembers. Any ad may be refused at the discretion of the Editor. Submit ads to mdloogatch@chicagoherp.org.

NEW CHS MEMBERS THIS MONTH

Regina Waldroup
Vicki Edwards
Colleen Grandrath
Dennis Magee

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Minutes of the CHS Board Meeting, June 16, 2017

President Rich Crowley called the meeting to order at 7:40 P.M. Board members John Bellah, Lisette Chapa, Andy Malawy, Linda Malawy and Jessica Wadleigh were absent. The minutes of the May 1 board meeting were read and accepted.

Officers' Reports

Membership secretary: Mike Dloogatch read the list of expiring memberships.

Media secretary: Morgan Lantz will look into creating a LinkedIn company page for the CHS, for which Kim Klisiak will create a banner. Morgan summarized current online CHS media: Facebook—1415 followers; Meet-up—110 members; Instagram—124 followers; Twitter—235 followers. Mike

Dloogatch reported that all issues of the CHS *Bulletin* for the years 2002–2016 can now be downloaded as pdfs from the CHS website.

Sergeant-at-arms: Attendance at the April 26 general meeting was 25.

New Business

Mike Scott requested that more of the business-card-size invitations to the CHS meetings be printed. John Archer will take care of it.

The meeting adjourned at 9:35 P.M.

Respectfully submitted by recording secretary Gail Oomens

SHOW SCHEDULE

In addition to ReptileFest the Chicago Herpetological Society puts on many live animal displays throughout the year. The events now scheduled for June through August are listed below. CHS members who wish to participate in an event should call or text ahead to Show Coordinator Dick Buchholz, 805-296-9516, to confirm.

- Notebaert Nature Museum, first full weekend of each month, Saturday and Sunday, 10 A.M. – 3 P.M.
- All Animal Expo, first Saturday & third Sunday of each month, 10 A.M. – 3 P.M., Dupage County Fairgrounds, Wheaton.
- Greek Festival, July 8–9, 3 P.M. – 9 P.M., St. Andrews Greek Orthodox Church, 5649 N Sheridan Rd., Chicago.
- Back to School Fair, August 12, 10 A.M. – 3 P.M., First Christian Church, Downers Grove.
- Raging Waves Waterpark, August 13, 10 A.M. – 6 P.M., 4000 Bridge St, Yorkville.
- BugFest, August 19, 9 A.M. – 2 P.M., Red Oak Nature Center, 2343 S River St, Batavia.
- Meet the Creek, September 16, Noon – 4 P.M., Kiwanis Park, Brookfield.
- Chicago Pet Show, November 11–12, 10 A.M. – 5 P.M., Kane County Fairgrounds, 525 S Randall Rd., St. Charles.

UPCOMING MEETINGS

The next meeting of the Chicago Herpetological Society will be held at 7:30 P.M., Wednesday, July 26, at the Peggy Notebaert Nature Museum, Cannon Drive and Fullerton Parkway, in Chicago. **Jason Juchems**, of Pekin, Illinois, will speak about “Captive Care and Breeding of Solomon Island Leaf Frogs (*Ceratobatrachus guentheri*).” Jason has worked as a keeper at the Wildlife Prairie State Park in Peoria, Illinois. He has served as president of the Central Illinois Herpetological Society. He has kept reptiles and amphibians since childhood and is the author of *Poison Dart Frogs: A Guide to Care and Breeding*.

The speaker at the August 30 meeting has not yet been confirmed.

The regular monthly meetings of the Chicago Herpetological Society take place at Chicago’s newest museum—the **Peggy Notebaert Nature Museum**. This beautiful building is at Fullerton Parkway and Cannon Drive, directly across Fullerton from the Lincoln Park Zoo. Meetings are held the last Wednesday of each month, from 7:30 P.M. through 9:30 P.M. Parking is free on Cannon Drive. A plethora of CTA buses stop nearby.

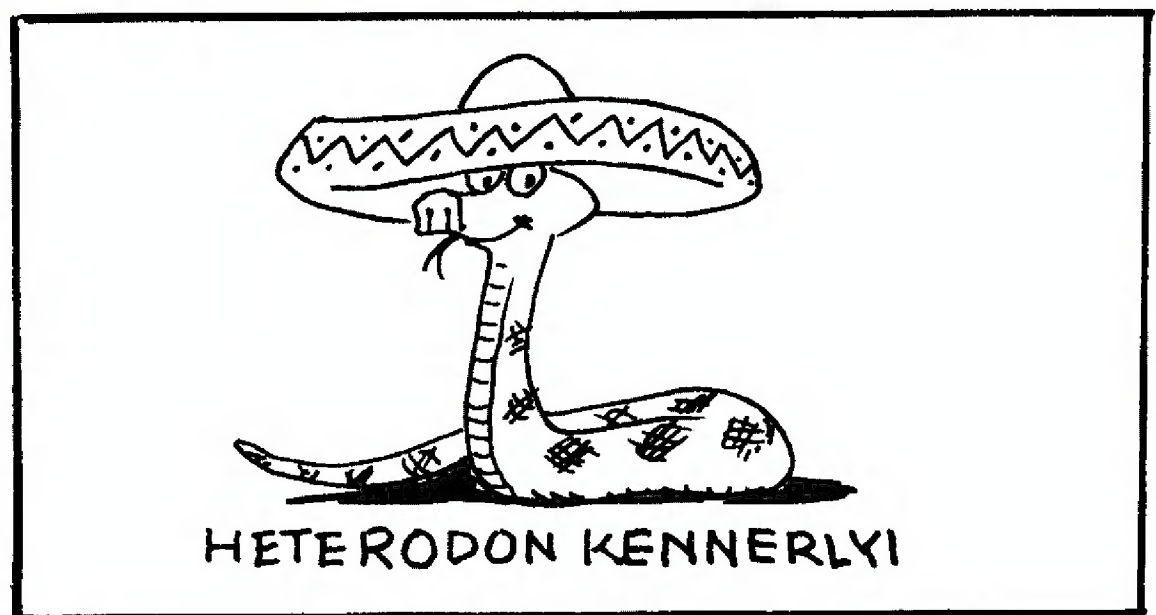
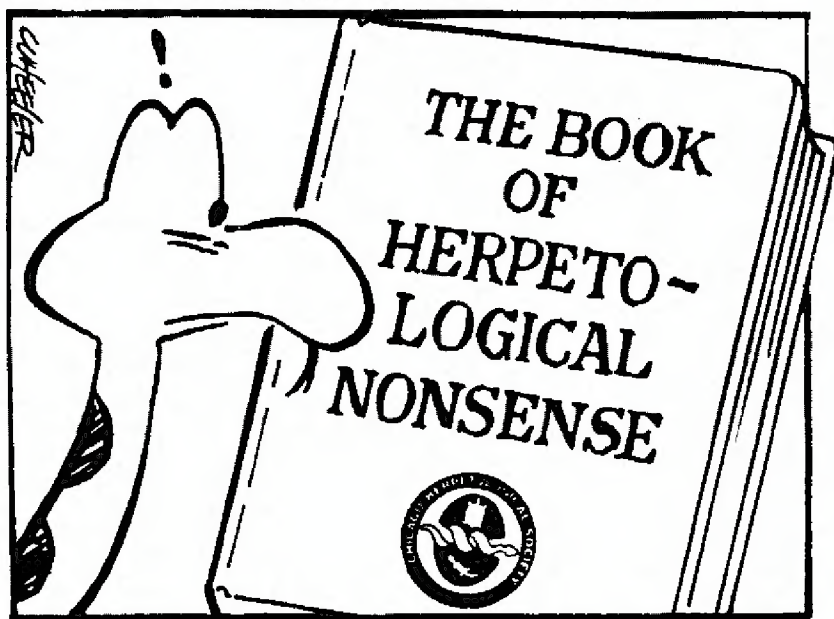
Board of Directors Meeting

Are you interested in how the decisions are made that determine how the Chicago Herpetological Society runs? And would you like to have input into those decisions? If so, mark your calendar for the next board meeting, to be held at 7:30 P.M., Friday, August 18, 2017, at the Schaumburg Township District Library, 130 S. Roselle Road, Schaumburg.

The Chicago Turtle Club

The monthly meetings of the Chicago Turtle Club are informal; questions, children and animals are welcome. Meetings normally take place at the North Park Village Nature Center, 5801 N. Pulaski, in Chicago. Parking is free. For more info visit the group’s Facebook page.

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